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The
HARD
RED
WINTER
WHEATS



HARD RED WINTER WHEAT is grown principally in the central Great Plains area, where hot summers and rather severe dry winters prevail. The States of Kansas, Nebraska, and Oklahoma lead in its production. More than 18,000,000 acres of this class of wheat are grown annually in the United States and comprise nearly one-third of the total wheat acreage.

From hard red winter wheat is produced flour of high bread-making quality.

There are 12 varieties of hard red winter wheat commercially grown in the United States, known under about 40 different names. Of these Turkey, Kharkof, and Kanred are the leading varieties. The Turkey and Kharkof are practically identical, and until the recent wide distribution of Kanred they made up nearly all of the hard winter wheat acreage.

Kanred has been grown commercially only during the past six years. It is resistant to some of the forms of leaf rust and stem rust that occur in the hard winter wheat section. It also is slightly more winter resistant than Turkey and Kharkof, ripens slightly earlier, and outyields these varieties in most sections.

Other new varieties have shown good local adaptation. Several nearly identical pure lines of Turkey or Kharkof, such as Nebraska No. 60, Iowa No. 401, Wisconsin Pedigree No. 2, and Montana No. 36, have outyielded the ordinary Turkey or Kharkof varieties in the States in which they were developed.

Blackhull has proved to be a high-yielding variety in certain sections of Kansas, principally because of its earlier maturity. Minturki has outyielded other hard red winter wheats in Minnesota because of its winter hardiness. Baeska has proved the best adapted variety for northern Wisconsin. Alton, a beardless variety, of comparatively poor yield and quality, should not be grown except where a beardless hard red winter wheat is desired.

THE HARD RED WINTER WHEATS.¹

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THE HARD RED WINTER CLASS OF WHEAT.

Wheat is graded in five classes under the Official Grain Standards of the United States. The third is designated as Hard Red Winter. About 32 per cent of the wheat acreage of the United States is of this class. The varieties that make up this important class of wheat have hard red kernels and are grown from fall sowing, chiefly in the central part of the United States. There are only a few distinct varieties grown. The original strains were introduced from Russia. They have become important in the United States because of their winter hardiness, drought resistance, and high yields. From hard red winter wheat is manufactured a flour of high bread-making quality.

WHERE HARD RED WINTER WHEATS ARE GROWN.

The hard red winter wheats are grown principally in the central Great Plains area. The States leading in the growing of this class of wheat are Kansas, Nebraska, and Oklahoma. A considerable acreage is grown also in Iowa, Illinois, Colorado, Texas, Washington, Oregon, Idaho, Montana, Missouri, and Indiana. Smaller acreages

¹The information given in this bulletin is based upon (1) varietal experiments conducted by the Office of Cereal Investigations of the U. S. Department of Agriculture and the State agricultural experiment stations, either independently or in cooperation; (2) classification studies of all American wheat varieties; (3) a survey of the wheat varieties of the United States, in cooperation with the then Bureau of Crop Estimates, based upon 19,000 returns from 70,000 questionnaires sent to crop correspondents; (4) several years of personal observation of the wheat fields in the States where these varieties are grown; and (5) milling and baking experiments conducted by the Milling-Investigations Section of the Bureau of Markets and Crop Estimates (now a part of the Bureau of Agricultural Economics) in cooperation with the Office of Cereal Investigations and also by the State agricultural experiment stations.

are grown in all other parts of the United States except the South-eastern States, the Atlantic Coast States, and the New England States. More than 18,000,000 acres, or nearly one-third of the wheat grown annually in the United States, is of the hard red winter class. The distribution of hard winter wheat in 1919 is shown on the accompanying map (Fig. 1).

AREAS TO WHICH HARD RED WINTER WHEATS ARE ADAPTED.

The hard red winter wheats are best adapted to a section comprising portions of Kansas, Nebraska, Oklahoma, and Colorado, having an annual rainfall of less than 35 inches. In this section there is

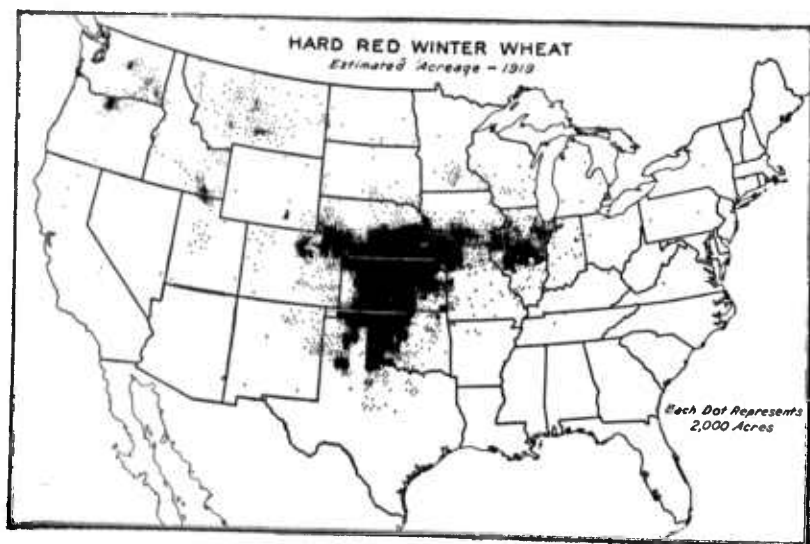


FIG. 1.—Outline map of the United States, showing where hard red winter wheat was grown in 1919. Estimated area, 21,677,900 acres.

little competition with other classes of wheat. As the annual rainfall increases eastward the hard red winter wheats come into competition with the soft red winter wheats. In eastern Kansas and Oklahoma, northern Missouri, southern Iowa, and central Illinois, where the annual rainfall varies from 35 to 40 inches, the hard red winter wheats are adapted only to the higher, drier, and less fertile soils. In some of the drier sections of Oregon, Washington, and Idaho, where the annual rainfall is around 15 inches, hard red winter wheat is well adapted also and successfully competes with several other classes of wheat. The hard winter wheats also are quite important in Minnesota, South Dakota, Wyoming, and Montana and are practically the only winter wheats which will survive the extreme

winter temperatures. In most parts of these latter States, however, spring wheats are of the most importance.

VARIETIES.

There are 12 varieties of hard red winter wheat commercially grown in the United States. These are known under about 40 different names. Only 6 of the 12 varieties can be distinguished by external characters. The others have slightly different adaptations to conditions in the United States, due to having come from different parts of Europe or to having been selected and developed in different parts of this country. During the past 15 to 20 years thousands of selections have been made at different agricultural experiment stations from the introduced bulk shipments of hard red winter wheat, and the best of these have been distributed as pedigreed or improved varieties.

For convenience in discussion the varieties of hard red winter wheat are divided into two sections on the basis of head characters.

DISTINGUISHING CHARACTERS AND VARIETIES.

Section 1.—Heads bearded: Turkey, Kharkof, Iowa No. 404, Nebraska No. 60, Nebraska No. 6, Wisconsin Pedigree No. 2, Montana No. 36, Kanred, Bacska, Blackhull, Minturki.

Section 2.—Heads beardless: Alton.

SECTION 1.—HEADS BEARDED.

The wheats of this section comprise 11 very similar varieties having bearded heads, with glabrous (not velvety) white chaff and hard dark-red kernels. These varieties often are referred to as the Crimean group of hard red winter wheat. The plants are of medium height and have slender stems which lodge easily in wet seasons. The leaves are dark green and very narrow. The heads are about 3 to 3½ inches long and rather narrow and tapering. The chaff usually is sufficiently firm to prevent loss from shattering. The kernels of the wheats of the Crimean group can be distinguished from any of the varieties of hard spring wheat by the rounded edges and the small area of the germ, or embryo. The kernels are also longer than those of most of the varieties of hard red spring wheat. These wheats are medium early in maturing. The leading variety of this section, or the Crimean group, is the Turkey.

TURKEY.

Turkey (Turkey Red) is known also by the following names: Alberta Red, Crimean, Defiance, Egyptian, Hard Winter, Hundred and One, Improved Turkey, Lost Freight, Malcome, Malakof, Minnesota Red Cross, Minnesota Reliable, Pioneer Turkey, Red Rus-

sian, Red Winter, Russian, Tauranian, and Worlds Champion. Other names, such as Argentine, Bulgarian, Hungarian, Romanella, and Theiss, have been applied to introductions of wheat apparently identical with Turkey which are grown only experimentally.

Turkey has the general characteristics mentioned for wheats of the Crimean group. The grains are hard and of a dull dark-red color. The "beaks" (short beards on the outer chaff) are about $\frac{1}{8}$ to $\frac{3}{8}$ inch long (Fig. 2, A). The variety is comparatively winter hardy and drought resistant. It also is fairly resistant to bunt or stinking smut in the Pacific Northwest. Turkey as originally introduced and as now grown on farms contains a number of types. Some of these types, which have been separated, were the source of new varieties or improved strains of Turkey.

Turkey wheat was introduced into the United States by Menonite immigrants from Russia about 1873. The original home of this wheat is in the portion of Russia just north and east of the Black Sea and north of the Caucasus Mountains. It was first grown in this country in Kansas and Nebraska. After the steel-roller mills were perfected, so that hard wheat could be properly ground, the growing of Turkey developed rapidly. To-day it is the most widely grown variety of wheat in the United States. More than 21,000,000 acres of Turkey were grown in 33 States of the Union in 1919. Of these, about 9,000,000 acres were grown in Kansas, 3,500,000 acres in Nebraska, and 3,200,000 acres in Oklahoma.

Turkey is best adapted to the areas shown in solid black on the accompanying map (Fig. 1). Previous to the development of the Kanred and Blackhull varieties, Turkey was the best yielding variety for those areas shown by the lighter dotted parts of the map. The districts of northeastern Kansas, northern Missouri, southern Iowa, and central Illinois are those in which both hard and soft red winter wheats are grown. In these sections the value of Turkey in comparison with other varieties depends on the soil, elevation, rainfall, and seasonal or local conditions, but in general several varieties of soft winter wheat are nearly or quite equal to Turkey. North and west of the area of heavy production of hard red winter wheat, the Turkey is one of the best adapted varieties of winter wheat.

Turkey is a high-yielding variety in southeastern Idaho and the adjoining section of Utah. It is the best variety of wheat for the western part of the Columbia basin of Oregon and is superior to other varieties of winter wheat in the drier portions of eastern Washington. In this latter section the comparative resistance of Turkey to smut gives it an advantage over the varieties of club or soft red winter wheats commonly grown in those districts.

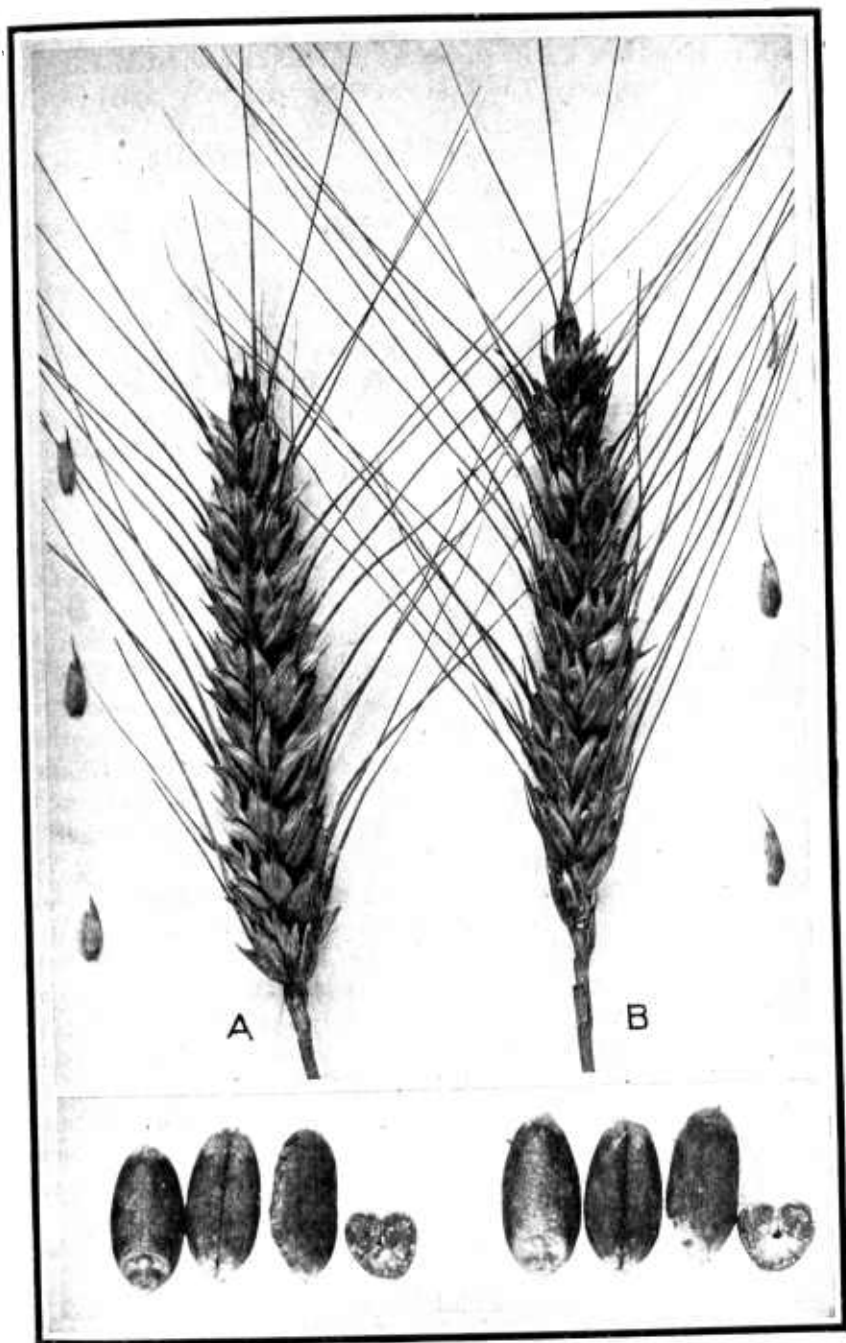


FIG. 2.—Turkey (A) and Kanred (B) varieties of hard red winter wheat. Spike, face view, natural size; glumes from lower, central, and upper portions of spike, natural size; kernels in three positions and in transverse section, magnified three diameters.

Turkey should not be grown in humid sections of the East or South or along the Pacific coast, as it is easily lodged and injured by excessive rainfall. The grain also becomes very starchy under these conditions.

From Turkey wheat is manufactured a flour of high bread-making quality. Turkey and Kharkof, the two standard but identical hard red winter wheats for flour making, are equal or superior to all other hard winter varieties in milling and baking quality.

KHARKOF.

Kharkof can not be distinguished from Turkey and should properly be considered as identical with that variety. One introduction of Kharkof contained about 80 per cent of plants having longer "beaks" (short beards on the outer chaff) than Turkey. Most of the Kharkof variety grown, however, is identical with Turkey in all observable characteristics.

Kharkof was first introduced into the United States from Starobielsk, Kharkof, Russia, in 1900, by Mark Alfred Carleton, of the United States Department of Agriculture. The Kharkof Government, where this wheat was obtained, is north of the section in which Turkey wheat was grown. It was thought, therefore, that Kharkof would be more winter hardy than Turkey. In the early experiments it gave better results than ordinary Turkey, but in recent years very little difference in hardiness or yield has been observed. Kharkof was quite widely distributed by the United States Department of Agriculture and several State agricultural experiment stations in the early years of the present century.

Kharkof is grown in the same areas as Turkey and frequently is not considered distinct or kept separate from that variety. This is especially true in Kansas, where Kharkof is grown to a considerable extent, but in Montana, where it probably is more widely grown than Turkey, its identity has been more carefully preserved.

Kharkof has yielded as well as Turkey in practically all sections where it has been grown. The average yields of the two varieties during a long period of years frequently are about the same. In the Great Plains area, however, Kharkof appears to give slightly higher yields than Turkey, but only in Montana are the differences significant. Outside of the Great Plains area the differences are negligible. In milling and baking quality the Kharkof and Turkey varieties are identical.

IOWA NO. 404.

Iowa No. 404 can not be distinguished from Turkey and Kharkof. This is a selection from Turkey made at the Iowa Agricultural Experiment Station. It was first distributed from that station in 1913

and is now grown in Iowa, Illinois, and Wisconsin. It has given higher yields and is probably slightly hardier than Turkey in central Iowa.

NEBRASKA NO. 60.

Nebraska No. 60 is identical with Turkey in appearance. It is a high-yielding selection of Turkey developed at the Nebraska Agricultural Experiment Station. It was distributed by that station in 1918, after experiments had shown it to be a higher yielding strain than Turkey. Further experiments have shown it to be about equal to Kanred in yield except in rust years. Nebraska No. 60 is equal to Turkey in milling and baking value.

NEBRASKA NO. 6.

Nebraska No. 6 is nearly identical with Nebraska No. 60 and has the same history as that selection. In both yield and quality it is perhaps slightly inferior to Nebraska No. 60.

WISCONSIN PEDIGREE NO. 2.

This pure-line strain appears identical with Turkey. It was selected from Turkey at the Wisconsin Agricultural Experiment Station and was first distributed in 1918. It is now grown to a considerable extent in Wisconsin. It is more winter hardy and gives higher yields than Turkey in that State and is the highest yielding variety of wheat in the southern part of Wisconsin.

MONTANA NO. 36.

Montana No. 36 is identical with Turkey and Kharkof in all observable characters. It is a selection from Kharkof, made at the Montana Agricultural Experiment Station, from which it was distributed in 1915. This wheat is grown to a considerable extent in Montana, but its rapid increase has been prevented during recent years by severe winterkilling. Montana No. 36 is as winter hardy as Turkey or Kharkof and has given slightly higher yields in some sections of Montana. It also is equal to these varieties in milling and baking quality.

KANRED.²

Kanred (formerly known as P-762) differs from Turkey chiefly in being resistant to several forms of stem and leaf rust. It also is slightly earlier and a little more winter hardy than Turkey. Kanred can be distinguished from Turkey by the longer beaks on its outer chaff. The beaks of Kanred vary from $\frac{1}{8}$ to 1 inch in length, while those of the Turkey and Kharkof varieties usually vary only from

² For a more complete discussion of this wheat, see Clark, J. A., and Salmon, S. C., Kanred wheat, U. S. Dept. Agr. Circ. 194, 13 pp., 3 figs. 1921.

$\frac{1}{8}$ to $\frac{3}{8}$ inch. (Fig. 2, B.) Kanred also has shown some resistance to bunt, or stinking smut, in the Pacific Northwest.

Kanred originated from a head selected from a plat of Crimean wheat by Prof. H. F. Roberts at the Kansas Agricultural Experiment Station in 1906. The parent variety, Crimean, is identical with Turkey and had been imported from Russia in 1900 by the United States Department of Agriculture. After being thoroughly tested by the Kansas Agricultural Experiment Station the Kanred variety was distributed in 1917.

Kanred is now widely grown throughout the entire State of Kansas and in the adjacent sections of Nebraska, Oklahoma, Colorado, Missouri, and in Texas. It is grown to a slight extent in several other States. It has been estimated that about 2,000,000 acres of Kanred wheat were grown in the United States in 1921.

Kanred may be grown with success wherever Turkey is grown. In Kansas, Nebraska, Oklahoma, Colorado, Texas, Wyoming, and South Dakota it should largely replace the Turkey and Kharkof varieties. Outside of this area it has shown little advantage over Turkey and Kharkof. Kanred is not well adapted to the humid sections and lower and heavier soils of eastern Kansas, southeastern Nebraska, and eastern Oklahoma. In these humid sections it yields as well as or better than Turkey, but is outyielded by varieties of soft winter wheat. In Montana and the regions west of the Rocky Mountains Kanred does not yield more than Turkey and Kharkof.

In experiments Kanred has been found about equal to Turkey and Kharkof in milling and bread-making value. It has a slightly higher bushel weight and produces a greater percentage of straight flour than Turkey and Kharkof grown under the same conditions, but has a slightly lower percentage of protein and produces a loaf of bread having a slightly smaller volume. In weight, texture, and color of loaf produced Kanred is about equal to the Turkey and Kharkof.

BACSKA.

Bacska, or Wisconsin Pedigree No. 408, is very similar in appearance to Kanred, but it is slightly taller and does not have the resistance of that wheat to stem and leaf rust. It has long beaks like Kanred. The kernels of Bacska are slightly larger and softer than those of Turkey and Kanred.

The Bacska variety originally was introduced into the United States from Budapest, Austria-Hungary, in 1900, by the United States Department of Agriculture. The Bacska wheat which is now grown in this country is a selection from this importation made by Prof. E. J. Delwiche, of the Wisconsin Agricultural Experiment Station, at the Ashland Branch Station. This pure-line strain was dis-

tributed from that station and is now the highest yielding variety of wheat for northern Wisconsin and should be more generally grown. In milling and baking value Bacska is equal to Turkey.

BLACKHULL.

Blackhull (known also as Clark's Black-Hulled and Black Chaff) can usually be distinguished by the black stripes or solid black color of the outer chaff. Under some conditions this black color is not apparent. Blackhull differs from Turkey also in being a little earlier and taller and in having a stiffer straw and somewhat larger and softer kernels. It heads relatively early, but ripens only a very few days earlier than Turkey. It is not resistant to rust or smut, but its earliness may enable it to escape severe rust injury. It is not as winter hardy as Turkey, Kharkof, and Kanred.

Blackhull originated from three heads found by Earl G. Clark in a field of Turkey wheat near Sedgwick, Harvey County, Kans., in 1912. The variety was increased by Mr. Clark and was first distributed in 1917. It has since become rather widely grown in Kansas, especially in the central part.

Blackhull has given yields about equal to those of Kanred in central and eastern Kansas and somewhat less than those of Kanred in western Kansas. Outside of Kansas this variety has not been especially promising, although in limited experiments it has given good comparative yields in northeastern Colorado and eastern Oregon. Owing to its lack of hardiness it should not be grown in sections having severe winters. Even in Kansas the severe winter weather which occurs not infrequently in the northwestern counties might result in heavy losses of Blackhull.

In the few milling and baking experiments thus far conducted Blackhull has produced a lower percentage of straight flour and a slightly lower loaf volume than Kanred, Kharkof, and Turkey. It is a softer wheat than the varieties mentioned and apparently is inferior to them for milling and bread making.

MINTURKI.

Minturki (Minnesota No. 1507) resembles Turkey, but differs in having a more slender head and softer and more slender kernels. It is very winter hardy, more so than any other variety of hard winter wheat. It originated from a cross between Turkey and Odessa (the latter a beardless soft red winter wheat). The cross was made at the Minnesota Agricultural Experiment Station in 1902. On account of its hardiness the variety was increased and first distributed in 1919. It is now grown to a limited extent in Minnesota.

Minturki has outyielded other varieties of winter wheat in Minnesota. Outside of that State it is not so promising, but it has given

fairly good yields in central Utah and central Montana. In these localities, however, it is outyielded by several other varieties of hard winter wheat. Where severe winterkilling may be expected Minturki offers considerable promise, especially in the subhumid and humid sections of the upper Mississippi Valley.

Minturki is softer than Turkey, Kharkof, and Kanred. When grown outside of Minnesota it is apparently inferior to them in flour yield and water absorption, but is about equal in protein content and equal to or superior to them in loaf volume. In Minnesota, where the development of this variety is more favorable, the Minturki has shown good comparative milling and baking quality.

SECTION 2.—HEADS BEARDLESS.

Only one commercial variety of hard red winter wheat is beardless.

ALTON.

Alton (Ghirka Winter) differs from Turkey in having beardless heads and shorter and softer kernels with a very small germ. Alton is of medium height and is midway in ripening, being usually a day or two later than Turkey. The straw is stiffer than that of Turkey. The heads are slender and tapering.

Alton was introduced into the United States from Altonau, near Melitopol, in northern Taurida, Russia, by the United States Department of Agriculture in 1900. It was distributed to some extent, but its production has never become important. The wheat was formerly called Ghirka Winter, but has recently been renamed Alton. Mixtures of beardless hard red winter wheats nearly identical with Alton frequently are found in fields of Turkey. Many of these mixtures have been isolated and tested, but none of them has been grown commercially.

Alton is now grown to a slight extent in Colorado, Kansas, and Wyoming. In Colorado and Wyoming it is generally known as Ghirka Winter, but in Kansas its identity is lost.

Alton has given good yields in northeastern Colorado and southeastern Wyoming, but even in these sections the yields are less than those of Turkey, Kharkof, and Kanred. Unless it is desired to grow a beardless winter wheat Alton should be entirely replaced by Kanred. In milling and baking value, Alton is slightly inferior to most other hard winter wheats.